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**Accelerating the assessment agenda: thinking outside the black box**

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# **TOWARDS A RESEARCH AGENDA ON COMPUTER-BASED ASSESSMENT**

**Challenges and needs for European Educational Measurement**

**Friedrich Scheuermann & Angela Guimarães Pereira (Eds.)**

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# Accelerating the assessment agenda: thinking outside the black box

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## Abstract

*Over the last 10 years, learning and teaching in higher education have benefited from advances in social constructivist and situated learning research (Laurillard, 1993). In contrast, assessment has remained largely transmission orientated in both conception and in practice (see Knight & Yorke, 2003). This paper examines a number of recent developments, which exhibit innovation in electronic assessment developed at the UK's Open University. This paper argues for the development of new forms of e-assessment where the main driver is that of sound pedagogy rather than state of the art technological know-how and where open source products can move the field forward.*

## Introduction

As teaching and learning cannot be separated from each other in practice it is difficult to think about learning without including assessment. It is well documented that assessment drives learning (see Rowntree, 1977) and teachers too, especially in the UK, are acutely aware of assessment targets with the introduction of league tables, (see the UK's Department for Children, Schools & Families Achievement and Attainment tables <http://www.dcsf.gov.uk/performance/tables/>).

Other types of testing such as the Programme for International Students Assessment (PISA) (<http://www.pisa.oecd.org/pages/>) and Trends in International Mathematics and Science Study (TIMSS) (<http://nces.ed.gov/timss/>) provide information to the bigger league table of the European Union. Although they are laudable how can the latter, with their well constructed tests, assist the students learning, profit the teaching and move us forward along the assessment agenda? By this I mean constructing a creative and collaborative milieu where the climate is not one of 'teaching for the assessment', but rather more of 'assessment for learning'. This paper argues for the development of new forms of e-assessment where the main driver is that of sound pedagogy rather than state of the art

technological know-how and where open source products can move the field forward.

## The constructivist learning push

Over the last 10 years, learning and teaching in higher education have benefited from advances in social constructivist and situated learning research (Laurillard, 1993). In contrast, assessment has remained largely transmission orientated in both conception and in practice (see Knight & Yorke, 2003). This is especially true in higher education where the teachers' role is usually to judge student work and to deliver feedback (as comments or marks) rather than to involve students as active participants in assessment processes.

However, recent research as well as highlighting the problems also holds the key to unlocking the assessment logjam. Firstly, there is recognition that the role of the student in assessment processes has until now been under-theorised and that this has made it difficult to address the relevant issues effectively. Students do not learn through passive receipt of teacher-delivered feedback. Rather, research shows that effective learning requires that students actively decode feedback information, internalise it and use it to make judgements of their own work (Boud, 2000; Gardner, 2006; Sadler, 1989). This, and other findings, emphasise that learners engage in the same assessment acts as their teachers and that self-assessment is integral to the students use of feedback information. Indeed, Nicol and Macfarlane-Dick (2006) argue that formative assessment processes should actually be designed to 'empower students as self-regulated learners'.

Another recent research direction has been to develop broader theoretical foundation for learning and assessment practice. The Assessment Reform Group (Gardner, 2006) have begun work on a theory of assessment relevant to the school classroom (Black & Wiliam, 2006). They adopt a community of practice approach (Lave & Wenger, 1991) and

interpret the interactions of assessment tools, subjects and outcomes from the perspective of activity theory (Kutti, 1996). There are four key components within this framework: (i) teachers, learners and the subject discipline (ii) the teacher's role and the regulation of learning (iii) feedback and the student-teacher interaction and (iv) the teacher's role in learning. Black and William (2006) argue that one function of this framework will be 'to guide the optimum choice of strategies to improve pedagogy'. Other researchers who have identified the need for a more complete development of theory in order to enhance pedagogic practice are Yorke (2003) and James (2006).

Another area of research is that showing the critical effects of socio-emotional factors in the design of assessment. Dweck and her colleagues (Dweck, 1999; Dweck, Mangel, & Good, 2004) have shown that cognitive benefits in assessment are highly dependent on emotional and motivational factors: beliefs and goals affect basic attentional and cognitive processes. In particular, this research shows that even small interventions in assessment practice can have dramatic impacts on learning processes and outcomes: e.g. focusing students on learning goals rather than performance goals before task engagement, praising effort rather than intellectual ability.

The vision for e-assessment in 2014 which is documented in Whitelock and Brasher's (2006) Roadmap study reveals that experts called for a pedagogically driven model rather than a technologically and standards led framework to lead future developments in this area. Experts believed that students will take more control of their own learning and become more reflective. The future would be one of more 'on-demand testing' that will assist students to realise their own potential and e-portfolios will help them to present themselves and their work in a more personalised manner. This notion is also supported by the then DfES (Department for Education and Skills) agenda to promote "personalised" learning, with e-assessment playing a large role. However the production of such software is costly and requires large multidisciplinary teams. One of the ways forward then is to adopt the open source model as advocated by the JISC and the UK's Open University, which has funded many successful in house developments as illustrated below has adopted Moodle, an open source application as its VLE.

## **The role of feedback in assessment**

One of the challenges for e-assessment and of today's education is that students are expecting better feedback, more frequently, and more quickly. Unfortunately, in today's educational climate, the resource pressures are higher, and feedback is often produced under greater time pressure, and often later.

This raises the question of what is meant by *feedback*? The way our team (Watt et al, 2006) have defined feedback is that it is seen as additional tutoring that is tailored to the learner's current needs. In the simplest case, this means that there is a mismatch between students' and the tutors' conceptual models and the feedback is reducing or correcting this mismatch, very much as feedback is used in cybernetic systems. This is not an accident, for the cybernetic analogy was based on Pask's (1976) work, which has been a strong influence on practice in this area (e.g., Laurillard, 1993).

The Open University has been building feedback systems over a number of years. Computer marked assignments consisting of a series of multiple questions together with tutor marked assignments have provided the core of assessment for our courses for a number of years. There is now a move, like the school examination boards, towards synchronous electronic examinations. A study was undertaken by Thomas et al (2002) who found that post graduate computer students who completed a synchronous examination in their own home were not deterred by it and were happy to sit further examinations in this manner.

Another course at the Open University i.e. 'Maths for Science' aimed to take the findings of Thomas et al's study one step further. It not only offered students a web-based examination in their own home but also provided them with immediate feedback and assistance when they submitted their individual answers to each question. This design drew on the findings from the interactive self-assessment questions initially devised for an undergraduate science course 'Discovering Science' (Whitelock, 1999) which offered different levels of feedback when the student failed to answer a question correctly and a

similar system has also been employed by Pitcher et al (2002).

The Maths for Science software was built to deduct marks according to the amount of feedback given to a student when they answered a question. It was anticipated that the provision of partial marks for second and third attempts would encourage students to try questions that they might otherwise have ignored through lack of confidence or incomplete knowledge. Again, at its simplest the system awarded 100% of the marks for a question answered correctly at the first attempt, 65% to students who answered correctly after they received a text hint to help them select the correct response and 35% to students who gave the correct answer after receiving two sets of text hints. All students received a final text message, which explained the correct solution to the question, which had just been answered. This type of feedback is relevant to both student learning and the grading process. It integrates assessment into the teaching and learning feedback loop, and introduces a new level of discourse into the teaching cycle as advocated by Laurillard, (1993).

'Maths for Science' was a short course (worth 10 credits only) and was designed to teach students the necessary algebraic skills to progress to second level scientific courses. The maintenance of short courses is a resource heavy exercise, and online delivery reduced the amount of time required to process results and awards. Unlike long Open University courses (60 credits), short courses were produced for students to enhance their own study skills, and therefore little benefit would be gained from cheating in the examinations. All the students managed to take the examination at home after a practice examination was attempted. They found it easy to use and felt they learnt a lot with this format, especially when the reasoning for each correct solution was revealed (Whitelock and Raw 2003). They were also pleased to obtain partial credit for their answers.

Other systems have shown the benefits of providing minimal immediate feedback to students for university examinations taken not at home but in a room full of colleagues working with computers under normal examination conditions. This modus operandi has been adopted by the Geology department

at Derby University who developed TRIADS software which has been used for end of year examination

(<http://www.derby.ac.uk/assess/newdemo/mainmenu.html>).

The above examples all suggest that providing feedback during electronic assessment has a broad appeal for students. It has also been documented that this type of feedback enhances learning in a variety of fields (Elliott, 1998; Phye and Bender, 1989; Brosvic et al 1997). A delay on the other hand may reduce the effectiveness of feedback (Gaynor 1981; Gibbs and Simpson, 2004). These findings indicate that systems, which provide immediate feedback, have clear advantages for students engaging in a learning dialogue during and after electronic assessment is of value but how can students collaborate on electronic assignments?

This notion that knowledge and understanding are constituted in and through interaction has considerable currency and a growing body of work emphasises the need to understand the dynamic processes involved in the joint creation of meaning, knowledge and understanding (e.g. Grossen & Bachmann, 2000; Murphy, 2000; Littleton, Miell & Faulkner, 2004; Miell & Littleton, 2004). The theoretical background here is of social constructivism which builds upon the notion of interaction with significant others in the learning process. Creating a sense of presence online and an environment that can be used to encourage students to work collaboratively on interactive assessment tasks is certainly a challenge.

Our most recent project has embellished an application known as "BuddySpace" (see Vogiazou et al, 2005), which was developed by KMi at the Open University to provide a large-scale informal environment for collaborative work, learning and play. It utilises the findings from distance education practice (Whitelock et al, 2000) that the presence of peer-group members can enhance the emotional well-being of isolated learners and improve problem-solving performance and learning. Rheingold (2002) too discusses the power of social cohesiveness that can be achieved through the simple knowledge of the presence and location of others in both virtual and real spaces.

BuddySpace builds on the notion of an Instant Messaging system that has a distinct form of user visualisation that is superior to a conventional 'buddy list'. In fact, BuddySpace provides maps to represent each group member's location (see Figure 1 below)

This allows a new member of the group to see if there are any other members from the same course living close by. BuddySpace is a piece of open-source software and, to date; Eisenstadt reports that it has been downloaded by some 19,000 users. Presence and availability can also be conveyed with this system showing 'available for chat', 'do not disturb'; 'low attention' or 'online but elsewhere'.

In order to give students the opportunity to work together on complex formative assessment tasks we added other features to BuddySpace. These features allow users to add details of their expertise and interests into a database so that other users could find them in order to seek out their expertise on a variety of topics and to 'yolk' PCs together so that two students could see and synchronously interact with a software simulation. Hence BuddyFinder and SIMLINK were developed by IET and KMi.



**Figure 1:** BuddySpace location map

In Figure 2 below, the two 'students', Chris and Simon, both see the same set of sliders and graphs on their screens. As one student moves a slider, the other student sees the same action on his screen. In other words both students view identical screens at the same time. An action on one student's screen is mirrored on the others. (The simulation shown in Figure 2 is a version of the Global Warming simulation used on the science foundation course)

The goals of this particular work is to build open source applications that will assist science and technology courses to construct complex problem solving activities that require a partner to assist with their solution as well as more straightforward feedback systems for individuals to use to test their understanding of a particular domain.



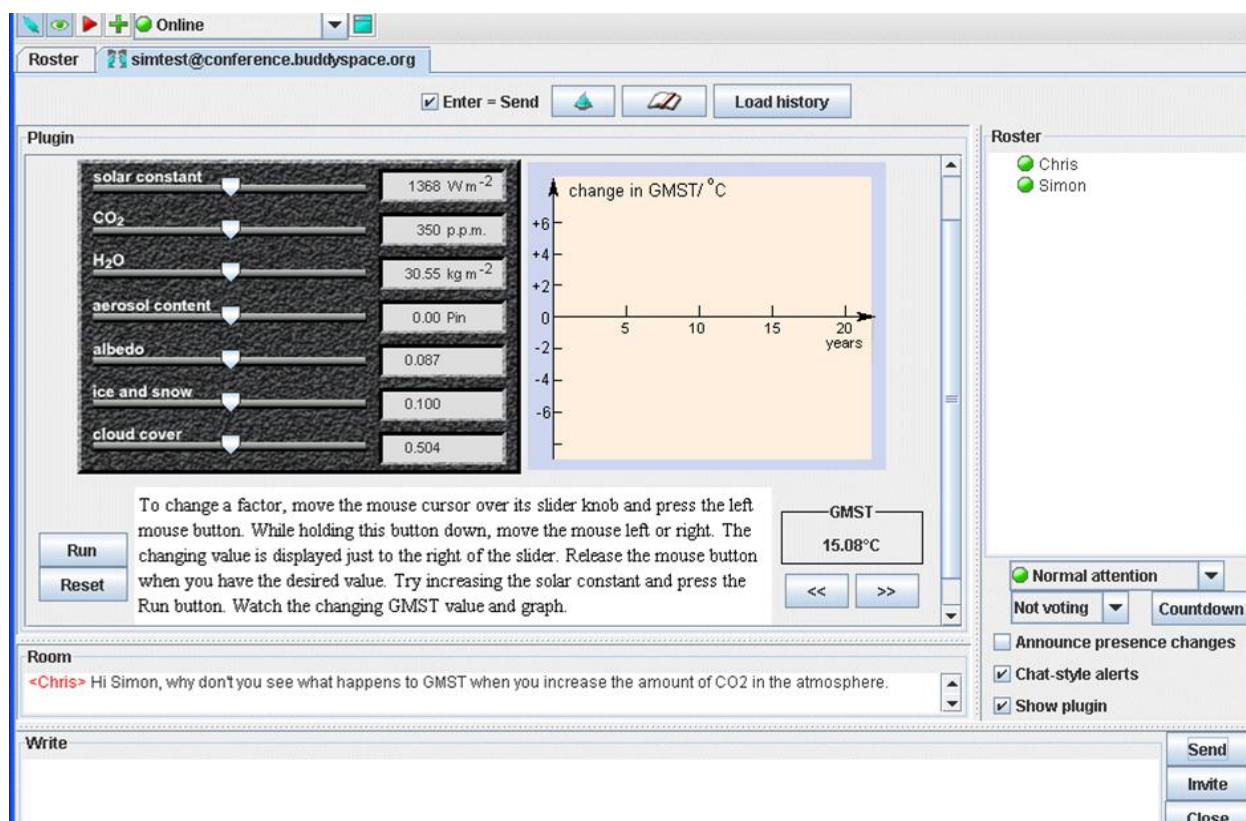


Figure 2: SIMLINK

Because feedback is very much at the cutting edge of personal learning, Whitelock and Watts (2007) wanted to see how we could work with tutors to improve the quality of their feedback. To achieve this, we have been working on tools to provide tutors with opportunities to reflect on their feedback. The latest of these, Open Mentor, (<http://kn.open.ac.uk/workspace.cfm?wpid=4126>) is an open source tool which tutors can use to analyse, visualise, and compare their use of feedback. For this application feedback was considered not as error correction, but as part of the dialogue between student and tutor. This is important for several reasons: first, thinking of students as making errors is unhelpful – as Norman (1988) says, errors are better thought of as approximations to correct action. Thinking of the student as making mistakes may lead to a more negative perception of their behaviour than is appropriate. Secondly, learners actually need to test out the boundaries of their knowledge in a safe environment, where their predictions may not be correct, without expecting to be penalised for it. Finally, feedback does not really imply guidance (i.e. planning for the future) and we wanted to incorporate that type of support

without resorting to the rather clunky 'feed-forward'.

The lessons learned from Open Mentor can be applied to feedback to students during or immediately after electronic assessments. This will assist them to take more control of their own learning and will also recognise their anxiety which is provoked by the test environment. This is a position argued by McKillop (2004) after she asked students to tell stories about their assessment experiences in an on-line, blog-style environment. This constructivist approach also aimed to involve students in reflective and collaborative experiences of their assessment experiences. The insights gained from this project are currently being applied to a new feedback system developed at the Open University for electronic formative assessment of history students that uses free text entry with automatic marking and is known as Open Comment.

(<http://kn.open.ac.uk/workspace.cfm?wpid=8236>)

## Conclusions

In today's educational climate, with the continued pressure on staff resources, making

individual learning work is always going to be a challenge. Assessment is the main keystone to learning and lack of submission of assessments often leads to student drop out in higher education (Simpson, 2003). However it is achievable, so long as we manage to maintain our empathy with the learner. Embracing constructivism and developing new types of e-assessment tools can help us achieve this by giving us frameworks where we can reflect on our social interaction, and ensure that it provides the emotional support as well as the conceptual guidance that our learners need.

Technology to enhance assessment is still in its early days, but the problems are not technical: assessment raises far wider social issues, and technologists have struggled in the past to resolve these issues with the respect they deserve. A community of open source developers collaborating on these big issues can offer a new way forward to these challenges. e-Assessment is starting to deliver potential improvements; but there is still much work to be done.

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Dr Denise Whitelock currently directs the OU's Computer Assisted Formative Assessment project (CAFA) which has three strands: (a) building a suite of tools for collaborative assessment; (b) working with different Faculties to create and evaluate different types of formative assessments; (c)

investigating how the introduction of a Virtual Learning Environment (Moodle) is affecting the development of formative assessments in the Open University. All these e-assessment projects demonstrate the synergy between Denise's research and practical application within the Open University.

She has also led the eMentor project, which built and tested a tutor mentoring tool for the marking of tutors' comments on electronically submitted assignments. This project received an OU Teaching Award. Denise is a member of the Educational Dialogue Research Unit (EDRU) Research Group and Joint Information Systems Committee (JISC) Education Experts Group. In November 2007 she was elected to the Governing Council of the Society for Research into Higher Education.



